orang—it is unbelievable and inapposite, and consequently is one of the few unconvincing stories in Kipling's otherwise admirable and truthful studies of the East.

But the author of "Distinguished Animals" cannot be held responsible for Mr. Kipling's rare slip in accuracy, and it is pleasanter to assert the general interest which the work under review possesses (apart from its remarkably good illustrations) for those who are not well acquainted with the history and habits of that marvellous collection of living creatures to be seen in Regent's Park. H. H. JOHNSTON.

THE KANGRA EARTHQUAKE OF APRIL 4, 1905.[1]

DESTRUCTIVE earthquakes are, fortunately, rare events, and when a civilised country is visited by one, the talk of investigating and of writing the report, which is now considered obligatory, falls necessarily on someone who has often more regular occupation. Hence it comes that we have to wait years for a connected account of a great earthquake, and that which visited the Punjab on April 4, 1905, is no exception; after the lapse of more than five years, with all the dignified delay, and, it must in fairness be added, all the thoroughness worthy of a great Government, the report on this earthquake, by Mr. C. S. Middlemiss, has appeared.

Nor could the memoirs have appeared more opportunely. The glamour of the great disaster which followed on the Californian earthquake, the remarkable character of the earth-movements which took place along the length of the San Andreas fault, and especially the fact that a very large part of the peculiarities of distribution of the shock seemed explicable on the hypothesis that fault and earthquake were related as cause and effect, have all given impetus to the popular notion that earthquakes are always a necessarily due to fracture. Yet even where faulting is observable there are generally indications that the fault is certainly not the sole cause, if it may be properly regarded as a cause of the earthquake; and now we have an account of a shock comparable in extent and violence with the Californian earthquake examined with great care and thoroughness of which the reporter writes that:—

> it may come as a surprise to many to be assured that the Kangra earthquake presents no evidence at all in support of this view: not a single railway has recorded any damage to the track, not a single road or path has been deflected, raised or lowered, no rivers or streams have changed their courses or been temporarily dammed up—except as due directly to landslips from slopes of such steepness that they might as easily have occurred after a heavy torrential rainstorm.

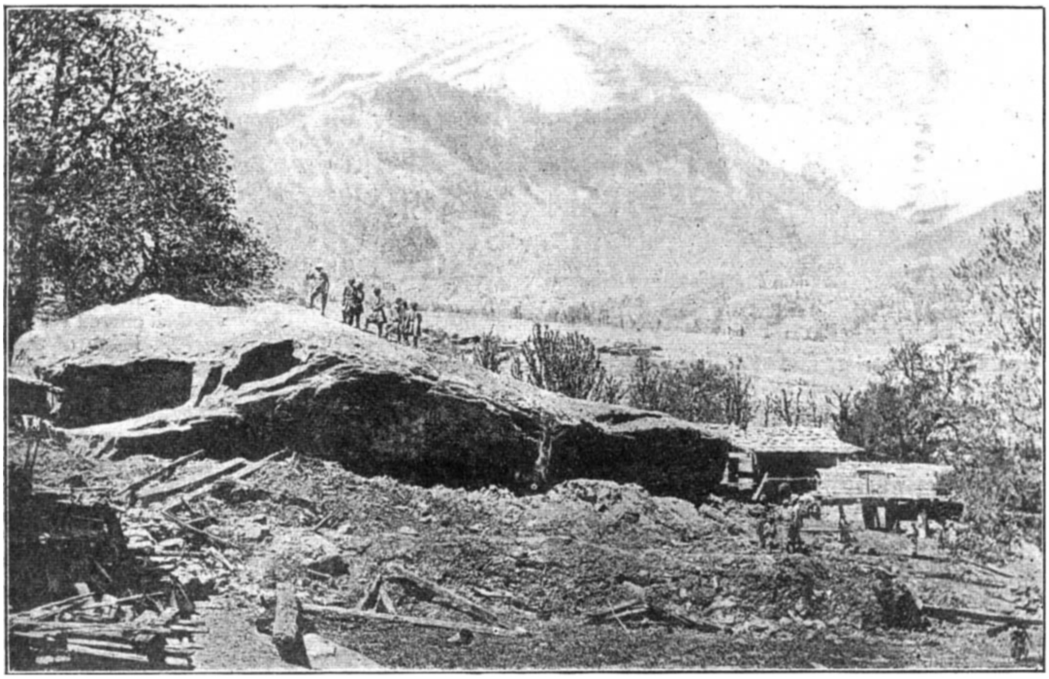

FIG. 1.—Fallen Rock near Manoli. From "The Kangra Earthquake of April 4, 1905."

The greater part of the report is taken up with details of damage done to buildings, the sensations of observers and other stock subjects, in all of which little or nothing of novelty can be found; but when we come to the discussion of the cause of the earthquake there is much that is interesting and suggestive. The author, after discussing the nature of the origin, finally adopts the conclusion that there were two centres of origin, one in the Kangra valley and the other in the Dehra Dun. He points out that these two regions lie in imbayments of the great faulted boundary between the rocks of the Himalayas proper and the Tertiary beds originally formed as fringing deposits of Himalayan débris.[1] Moreover, it is just in these imbayments that an exceptional development of coarse boulder deposits indicates the position where great rivers issued from the mountains, where sedimentation was in excess, and where, in the subsequent compression and folding of strata, irregularities of packing might be expected to occur. So the conclusion is reached that the earthquake was a tectonic one, due to a sudden rupture or release of

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[1] Memoirs of the Geological Survey of India, vol. xxxviii. "The Kangra Earthquake of April 4, 1905." By C. S. Middlemiss. Pp. x+409+xxi+30 plates. (Calcutta: Geological Survey; London: Kegan Paul and Co., Ltd.; Berlin: Friedländer and Sohn, 1910.) Price Rs. 5.

[1] NATURE, March 1, 1906 (vol. lxxiii., p. 418).

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strain at two places where the strain was specially great owing to resistances to the well-established forward march of the overthrusting foot of the Himalayan range.

All this is perfectly clearly put, the argument is logically arranged and the conclusion is perfectly orthodox; but yet we must confess that in reading Mr. Middlemiss's description we were struck by many indications of the absence of direct connection between earthquake and geological structure. The principal focus of maximum intensity extends from the sub-Himalayan area across the great boundary fault, which is by far the grandest structural feature of the region; and the subsidiary focus in the Dehra Dun shows no tendency to a concentration of violence along any particular line or connection with any known structural feature, and from this area some observations are recorded which seem to be of importance so far as the origin of earthquakes is concerned. An old line of levelling from Saharanpur to Mussooree was gone over again after the earthquake with the result that although the relative levels of the extremities of the line were unchanged, it was found that the intervening bench marks in the Dehra Dun and the Siwaliks showed an elevation of from 4 to 5 inches. As no alteration in the relative level of Dehra Dun and Mussooree had been noticed when this section was re-levelled in May, 1904, it is practically certain that the change took place at the time of the earthquake. Now if the results are examined it may be noticed that elevation was not confined to one station, as might be expected had it been due to shifting of the opposite sides of a fault, but is rather a general bulging upwards, such as might be produced by a sudden increase in volume of the material underlying the region of greater violence of shock.

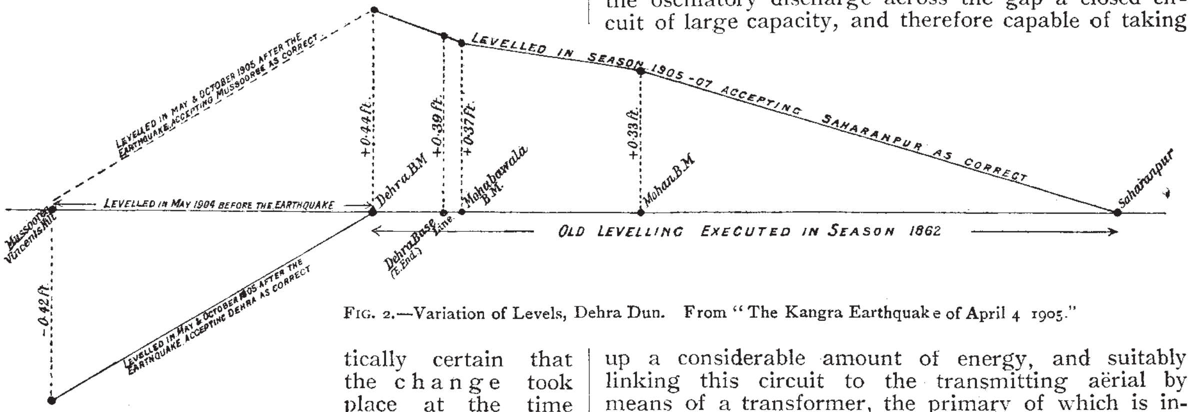
LEVELLED IN MAY & OCTOBER 1905 AFTER THE EARTHQUAKE ACCEPTING MUSSOORIE AS CORRECT
LEVELLED IN SEASON 1905-07 ACCEPTING SAHARANPUR AS CORRECT
+0.44 ft.
+0.39 ft.
+0.37 ft.
+0.33 ft.
Dehra B.M
Mohabawala B.M.
Mohan B.M
Saharanpur
Mussooree Vincents Hill
LEVELLED IN MAY 1904 BEFORE THE EARTHQUAKE
Dehra Base Line (E. End.)
OLD LEVELLING EXECUTED IN SEASON 1862
-0.42 ft.
LEVELLED IN MAY & OCTOBER 1905 AFTER THE EARTHQUAKE ACCEPTING DEHRA AS CORRECT

FIG. 2.—Variation of Levels, Dehra Dun. From "The Kangra Earthquake of April 4 1905."

These, however, are matters of inference and interpretation, and whatever may be the ultimate trend of thought as concerns them, the memoir under review will stand as an important contribution to knowledge which will have to be studied and reckoned with by all who attempt to deal with the vexed question of the nature and origin of earthquakes.

WIRELESS TELEGRAPHY SYSTEMS.

THE action brought by Mr. Marconi and Marconi's Wireless Telegraph Co., Ltd., against the British Radio-Telegraph and Telephone Co., Ltd., for infringement of patent No. 7777 of 1900, concerning improvements in apparatus for wireless telegraphy, has been concluded, and Mr. Justice Parker delivered judgment on February 21 in favour of the plaintiffs.

The patent in question refers to an arrangement of the sending and receiving circuits in such a manner as to make telegraphy possible over increased distances by means of spark methods. In the methods in which spark-dischargers are used, a spark is caused to bridge the gap by the application of a direct-current or alternating-current supply, and it is arranged that the discharge thus produced should form part of a circuit in which high-frequency oscillations may be set up. This circuit must contain a capacity and inductance, and the charge and discharge of the capacity taking place through it will be of an oscillatory nature if the resistance of the cricuit be not greater than $\sqrt{\frac{4L}{K}}$, where L and K represent the inductance and capacity of the circuit. When the resistance is greater than this value, the discharge is not of an oscillatory nature, and is therefore unsuitable for the production of waves for wireless telegraphy.

In early methods of working the gap was placed directly between the aërial and an earth-plate, and the discharge produced by connecting an induction coil across the gap. The oscillating circuit consisted of the spark-gap and the capacity and inductance of the aërial, and the energy that could be radiated was small owing to the very small capacity of the aërial. The receiving circuit consisted of an aërial connected to earth through a coherer, which formed part of a relay circuit actuating a Morse printing instrument.

The improvement constituting the subject-matter of the patent under discussion consists in providing for the oscillatory discharge across the gap a closed circuit of large capacity, and therefore capable of taking up a considerable amount of energy, and suitably linking this circuit to the transmitting aërial by means of a transformer, the primary of which is inserted in the closed circuit, and the secondary of which is connected in the aërial. By this means oscillations of great energy are able to be set up in the closed circuit, and if the aërial circuit be tuned to have the same frequency of oscillation as this circuit, and be loosely coupled to it by the transformer, long trains of waves of a single frequency will be radiated by the aërial, which is, in virtue of its open circuit, a good radiator of the energy gradually supplied to it by the good oscillator formed by the closed circuit.

A similar idea underlies the arrangement adopted for the receiving circuit, in which a good absorber consisting of an open circuit containing the aërial is linked by a transformer to a poor radiator, and consequently a good accumulator of energy consisting of a closed circuit.

The apparatus of the British Radio-Telegraph Co. is substantially similar to that described above, with the exception that the oscillating and radiating circuits at the transmitting end, and the receiving and storing circuits at the receiving end, are connected by means of a single-coil transformer or auto-transformer instead of a two-coil transformer, as is used in the Marconi arrangement.

A considerable portion of the proceedings was occupied in the discussion whether the use of a single-coil transformer in the place of a two-coil transformer constituted an infringement or not, and the judgment

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